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Food Availability and Nutrition in a Seasonal Perspective: A Study from the Rukwa Region in Tanzania

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Most of the studies on seasonality in food supply and nutritional status have been carried out in areas characterized by extreme climatic conditions. This study was conducted in an area where the climate is favorable for grain cultivation. However, a large part of the population was found to face seasonal variations in food availability, most critically three to four months before the main harvest. Women lost about 3 percent of their weight in this period compared to the post harvest period. The nutritional status of preschool children declined in the lower socio-economic group. These changes also coincided with a period of hard agricultural work, especially for women. The paper deals with factors affecting the duration of the maize stocks as well as strategies used when maize stocks are exhausted.

KEY WORDS: seasonality; food availability; nutrition; Tanzania.

INTRODUCTION

Seasonal variation in food availability has long been recognized as a contributor to nutrition and health problems in many Third-World countries. The extent and duration of the seasonal hardships have been related to a number of climatic characteristics, such as rainfall modality, the distinctness of the seasons, and the length of the dry period(s) (Chambers et al., 1981). By comparing dietary studies from 25 villages in Africa, Schofield (1974) found that seasonality affected food intakes mostly in areas where the distribution of rainfall is unimodal. The lowest intakes were in the wet season, the period when work outputs were at a peak, the result being a gross imbalance between intake and requirements. In areas with bimodal

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distribution of rainfall the fulfillment of calorie requirements was not significantly different in the wet and dry seasons.

Households facing recurrent threats of food shortage use a variety of means to obtain the food they need (de Garine and Harrison, 1988; Nabarro et al., 1989). This behavior can be seen as more or less conscious strategies to reduce the likelihood of seasonal stress in food availability. If a crisis is inevitable, attempts are made to minimize its consequences. The successfulness of these strategies depends on a number of factors—material and nonmaterial—which define the limits within which household members can operate. For example, the resource base, social network, and household structure may be important factors in the choice of strategies, as well as the outcome. Therefore, people who harvest similar amounts of food crops may face a different food situation in the lean season.

The effect of seasonality on the food availability and nutritional status is aggravated if the seasonal burdens are unequally distributed between social groups within the society. Research on this issue is however scant, but indicates that there is a tendency in rural societies for seasonal burdens to be transferred from dominant to weaker groups: from land owners to landless, from employers to laborers, and from men to women and children (Chambers et al., 1981). In many societies the better-off farmers can solve their labor problems by hiring people from lower socioeconomic strata to do the work. They may thus be able to secure enough food for their families for the lean season as well as a surplus for sale. The consequences of this practice for the agricultural workers may vary depending on the context. Where land is scarce agricultural wage work may be one of the few sources of livelihood for the landless or near landless. The withdrawal of such work opportunities may thus have detrimental effects on these poor groups, especially if it occurs as a consequence of drought or other crises affecting the productive base. For farmers with access to land, working for others may limit their opportunities for timely cultivation of their own crops and thereby increase the seasonal burdens (Kumar, 1988).

In areas where women or children are already discriminated against in the distribution of food within the household, they may suffer even more in seasons of food shortage (Safilios-Rotschild, 1980; Schofield, 1974). In this way, the weaker groups may buffer the harsh seasonal reality for the rest of the population. Therefore, in societies which on the whole are characterized by a relatively low degree of seasonality, but have a high degree of inequality, there may be subgroups that are severely affected.

Many studies of seasonality in food availability and nutrition status have been carried out in areas characterized by extreme climatic conditions, such as those which are drought stricken. This study is from an area where the physical conditions are less extreme. Even though the rainfall is uni-

modal, the climate is favorable for grain cultivation due to a rather long rainy period and access to irrigation from brooks and springs in the dry season. As a result the area has become a net surplus producer of maize. In fact, the Rukwa region is considered the "granary" of Tanzania.

In another paper based on this study we have reported on the agricultural schedule of different crops and energy intake/energy cost of work in different seasons (Wandel et al., 1992). In this paper we are presenting a closer examination of the seasonal reality, with a special emphasis on subgroups of the population which are often found to be affected nutritionally by seasonal hardships. We will in particular examine the significance for the households of keeping food in stock. The analyses focus on maize, the major staple food, and include factors determining the duration of the household maize stocks as well as the strategies people use to secure maize and other foods in the face of recurrent fluctuations in food availability.

STUDY AREA

The study was carried out on the Ufipa plateau in the Rukwa region in Tanzania. The altitude is about 1800 m, and the area is covered with grassland, interspersed with woods. The majority of the people, who belong to the Fipa tribe, are subsistence farmers. Maize, beans, and finger millet are the most important food crops in the study area. In addition, groundnuts, potatoes, various vegetables, fruits, and green leaves are cultivated for consumption and sale by most farming households. Many farmers keep cattle as well as a few pigs and hens.

The rainfall varies from 800–1200 mm, occurring mostly from October/November to April/May, followed by the dry season. The various agricultural activities are organized according to these seasons. Cultivation is a joint responsibility of men and women. Men are mostly responsible for preparing the soil (October/November) and women for the weeding. During weeding time, from December to April, women could spend from 2 to about 10 hours per day in the field. Late April, May, and the beginning of June is a period of rest, before the main harvest in late June or July. The most labor intensive periods for women are the long weeding period and the short but intensive harvest period (Wandel et al., 1992).

During the last two decades there has been a gradual shift from the production of millet to maize as the major food crop. This switch has been accompanied by the introduction of modern techniques of cultivation, such as the use of the plow and fertilizer. This in turn has led to larger areas put under cultivation and to surplus production of food. It has also led to a larger involvement by men in the work of weeding, particularly of maize.

All the households have enough land to cultivate the food needed for their own consumption. However, due to the beginning of a land shortage, and the exhaustion of the soil, some households are cultivating land which is less fertile or located quite far away from their house. Some people walk 2 hours to the fields.

Even though most households are involved in farming and cultivate at least maize, some households reported other sources of income in addition, such as business (10%); public service (including, teachers and doctors) (8%); and skilled and unskilled non-agricultural work (5%). Most women also earn extra money through beer brewing (Wandel and Holmboe-Ottesen, 1992).

The malnutrition rate among children is high. Using the WHO (1983) reference and a cut-off point of 80% of the median weight-for-age, the malnutrition rate among preschool children was found to be 42% for the study area as a whole. This corresponds to the middle values obtained from other parts of Tanzania from 1980 and onwards (UNICEF, 1985).

RESEARCH DESIGN AND METHODS

The data presented in this paper are part of a larger project investigating gender roles and activities in relation to food production and nutrition. The field study was carried out over a period of 1 year in 1987/1988. Two neighboring villages were selected, which were very similar in terms of production and socioeconomic pattern. In fact, the average quantities of the major food crops produced were the same in the two villages (Wandel and Holmboe-Ottesen, 1992). In both villages people had access to good quality drinking water and health services. However, one of the villages was more integrated into the cash economy than the other; it had a marketplace and several small shops, was easily accessible, situated along a fairly good road, and was frequently visited by merchants. The other village did not have shops or a market place, was less accessible, and was visited less frequently by merchants.

The study consisted of two interrelated and overlapping components:

1. *Seasonal Monitoring.* Three surveys of 99 and 101 randomly selected households with preschool children in the two villages. The three surveys were carried out in April–May, the pre-harvest season (survey 1), July–August, the main harvest season (survey 2), February–March, the weeding season (survey 3). This component was quantitative in nature, based on questionnaires and nutritional survey techniques. The data reported here were collected in the following manner:

Food Stocks. In two pre-harvest seasons, the respondents were asked which month the stocks of maize, beans, and millet, obtained from the pre-

vious harvest (1986 and 1987), were exhausted. If they still had food in stock, the duration of these stocks was estimated, based on the amounts of remaining stocks and household needs. Number of months without food in stock and number of months with food in stock until next harvest (maximum 12) were then calculated.

Child Nutritional Status. Weight-for-age was used as the indicator. Children below 5 years were weighed on a Salter spring scale. Age was calculated from the birth date recorded on the weighing cards. Weight-for-age of each child was related to the 50th percentile of a reference population (WHO, 1983) and presented as percent of the reference. Weight-for-age, and not weight-for-height was chosen because, although weight-for-height is specific to short-term fluctuations, it is often a reflection of infectious disease rather than of moderate changes in food availability.

Feeding and Eating Events. The number of feeding events for children and eating events for adults are measures which include the number of meals plus eating events which occur in between regular meals. The numbers were calculated, based on yesterday's recall. The reason for choosing this indicator instead of number of meals is that it was observed that children could eat more food as snacks than as regular meals.

Consumption Units (CU) were based on the recommended intake of energy (FAO/WHO/UNU, 1985). Men aged 18–30 years had the highest recommended intake and were rated as 1 CU. Other household members were added as fractions of a CU according to the recommended intake for their age group (see Table I).

Socioeconomic Score. A composite index was calculated for each household on the basis of its possession of selected items, known to be related to the material standard of living in this area (wrist watches, buckets,

Table I. Consumption Units calculated from Recommended Energy Intake by FAO/WHO/UNU (1985)

Age group (yr)	Males	Females
1–2	0.38	
2–3	0.45	
3–5	0.52	
5–7	0.62	0.58
7–10	0.70	0.60
10–12	0.73	0.65
12–14	0.80	0.70
14–16	0.88	0.72
16–18	0.95	0.72
18–30	1.00	0.78
30–60	0.95	0.78

radios, bicycles, plows, number of rooms in the house). The items were weighted according to a method developed by Smith (1979) based on the deviance from the average. The scoring system has been used in earlier surveys by the authors (Holmboe-Ottesen et al., 1989). In this study an index of cattle ownership was also made, based on the same principle, and merged with the composite index, to calculate the socioeconomic score. The households were divided into three groups according to their socioeconomic score. The scores could be positive or negative, depending on the deviation from the average: Group 1: −13 to −6; Group 2: −5 to +3; Group 3: +4 to +24.

Involvement in Casual Agricultural Labor. Classification of households according to involvement in casual agricultural labor was done in the following way: Group 1 performed casual agricultural work (some also hired casual workers), Group 2 were not involved at all, and Group 3 hired agricultural laborers but did not do any casual work themselves.

Statistical Analyses were carried out using the following tests: analysis of variance (anova), anova for repeated measurements, *t*-tests, paired *t*-tests, chi-square, and a multivariate regression. Probability values below 0.05 were considered significant.

2. *In-Depth Study.* A qualitative study was carried out in 12 households in each village, selected from those included in the monitoring scheme. This study dealt more thoroughly with factors and processes affecting the diet, including strategies to secure food for the household, as well as labor input by women and men into food production. These data were collected at four times: February–March, April–May, July–August, and November–December.

RESULTS

Seasonal Variations in Weight and Nutritional Status

Nutritional status (weight/age) of preschool children, as well as weight of older children and adults were examined according to season for male and female members in the household, to see if there were seasonal variations and if the sexes were affected differently. The preschool children showed a significant decline in the average weight-for-age, calculated as percent of WHO reference (1983), from post-harvest to the pre-harvest season (Table II). There was no significant difference between the sexes and no indication of sex differences with regard to the seasonal variations.

Both mothers and fathers lost weight from post-harvest to the pre-harvest season, whereas their older children gained weight (Table III). The mothers lost on the average 1.7 kg and the fathers 0.6 kg. This corresponds to 3.2% and 1% of their body weights, respectively. This difference between

Table II. Nutritional Status Among Girls and Boys According to Season

Sex	*n*	Child nutritional status[a] weight/age (%) of WHO Ref. (1983)		Paired *t*-test significance between seasons
		Post-harvest (July/August)	Pre-harvest (February/March)	
Girls	138	84.5	82.1	0.011
Boys	150	84.2	82.2	0.008
Total	288	84.3	82.1	0.000

[a]Children were 0–60 months of age. They were removed from the study when they reached 60 months. Difference in weight/age between boys and girls by Students *t*-test: post-harvest, $p = 0.86$; pre-harvest, $p = 0.34$.

Table III. Seasonal Weight Changes According to Sex

Household members	*n*	Average weight (kg)		Percent weight loss	Anova stats[a]
		Post-harvest (July/August)	Pre-harvest (February/March		
Mothers[b]	123	52.3	50.6[c]	3.2	$F = 5.9$
Fathers	83	58.4	57.8	1.0	$p = 0.01$
				Percent weight gain	
Children 5–10					
Female	97	19.4	20.0	3.0	$F = 0.3$
Male	95	20.7	21.2	2.4	$p = 0.59$
Children 11–18					
Female[b]	62	32.2	33.8	4.7	$F = 1.8$
Male	45	32.5	33.5	6.6	$p = 0.19$

[a]Weight changes, difference between male and female, after controlling for the effect of village of residency.
[b]Pregnant women excluded.
[c]Difference between the seasons, paired *t*-test: $t = 5.5$, $p = 0.00$. Difference between seasons not significant for men.

the sexes was found to be significant. There was no significant difference between the sexes in regard to the weight changes registered for the older children.

In order to find out how these seasonal variations affected different socioeconomic groups, the households were classified according to (a) socioeconomic score, and (b) involvement in agricultural casual labor. Child nutritional status was selected as representative of nutritional status.

Nutritional status among preschool children showed seasonal differences in the three socioeconomic groups (Fig. 1). In all groups the highest average weight-for-age, compared to the reference, was measured in July, whereas those measured in February/March tended to be the lowest. How-

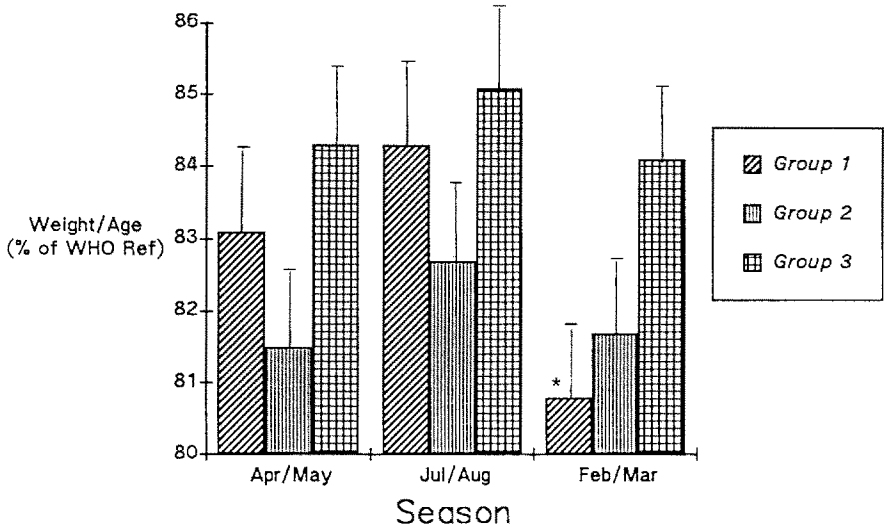

Fig. 1. Seasonal changes in nutritional status among 282 preschool children in three socioeconomic groups. Each bar represents mean weight for age as percent of WHO reference (1983), and standard error of the mean. Group 1: low; Group 2: medium; Group 3: high socioeconomic score. Seasonal trend of weight/age only significant for Group 1, $p < 0.01$ by analysis of variance for repeated measurements. Difference in seasonal trend between groups $p = 0.05$. *Difference from July/August, $p < 0.01$ by paired t-test.

ever, the seasonal differences were only significant in the lowest socioeconomic group, and between July/August and February/March.

The relationship to casual agricultural work did not affect the seasonal pattern of nutrition in this society. The average weight-for-age was, however, higher among those who hired casual laborers in all seasons. In the critical months of February/March the average weight-for-age of children of those who worked as casual laborers, those who were not involved at all, and those who hired casual workers was 81.7, 81.7, and 82.4, respectively. The seasonal changes were not significant in any of the groups.

The data above indicate that even though this is an area of surplus food production, there are seasonal problems related to the food and nutritional situation. We will therefore take a closer look at diet as well as factors influencing the seasonal fluctuations in food availability.

The Diet

After the switch from the production of millet to maize as the major grain for cultivation, maize had become the major staple food and main

ingredient in the diet both in meals and as snack food. The main dish at meals was *ugali*, a stiff porridge made of maize flour and eaten with a bean stew or relish consisting of vegetables or green leaves. Occasionally meat and dried fish were served. Small children were served *uji*, which is a thin gruel, also mostly made of maize flour and water. There were also dishes made out of unripe maize, such as *kande*, a stew made of maize kernels and beans, and corn on the cob, which was eaten boiled or grilled as a snack food or instead of a meal. The dietary data revealed that maize constituted around 70% of the energy intake in the pre-harvest season and around 60% in the post-harvest season. Beans contributed around 20% in the pre-harvest and around 30% in the post-harvest season.

Because of high water-binding capacity, dishes made from maize tend to have a low energy density. Furthermore, maize porridge and gruel have a low content of many nutrients, such as protein, vitamins, and minerals, compared to millet. This is especially critical in regard to children's food. With this type of diet the frequency of feeding becomes the more important. UNICEF (1985) recommended five meals or more per day, most mothers tried to give their children three meals a day, which they thought was sufficient for the weaned children. However, during times of food shortage or hard work in the field many failed to reach even this target.

Figure 2 shows the seasonal pattern of child feeding in the three socioeconomic groups. The seasonal trend was similar in all three groups.

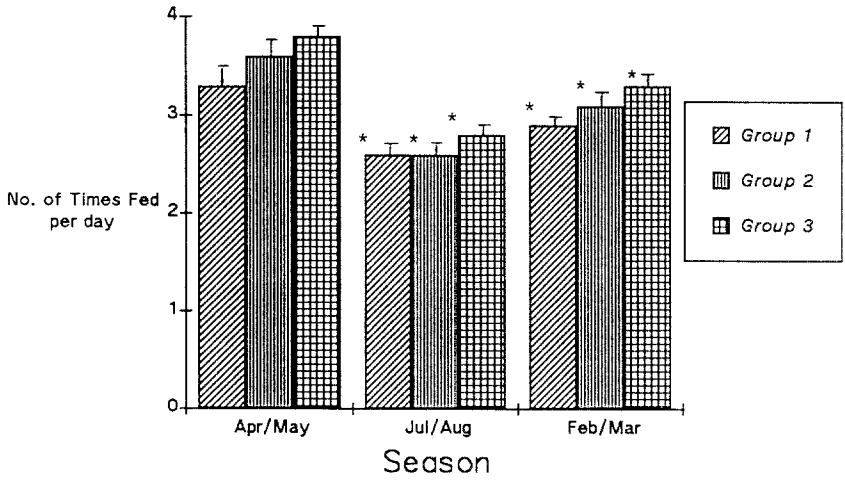

Fig. 2. Seasonal variations in the number of times preschool children were fed in three socioeconomic groups. Each bar represents the mean and standard error of the mean. Only children who were not breastfed were included in the analysis (n = 187). Group 1: low; Group 2: medium; Group 3: high socioeconomic score. Seasonal differences in child feeding in each of the socioeconomic groups is significant, $p < 0.01$ by analysis of variance for repeated measurements. *Difference from April/May: $p < 0.01$ by paired t-test.

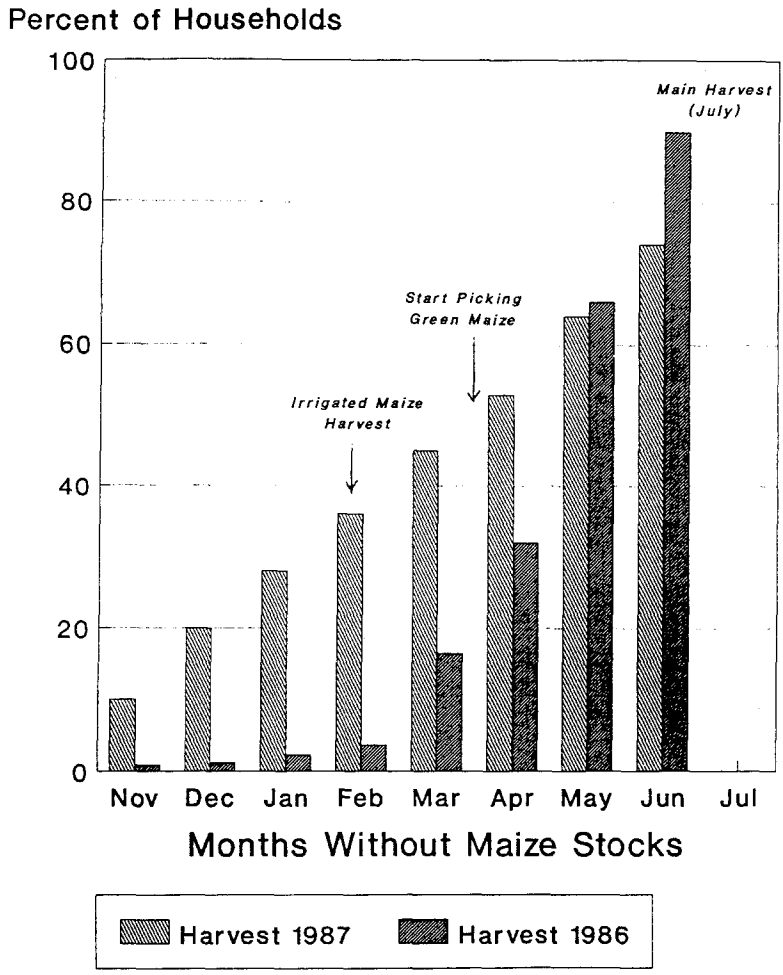

Fig. 3. Diminishing maize stocks at farm level. Preharvest season. Main harvest of maize in July.

The highest feeding frequency was in April/May. The decline in feeding frequency in July/August and February/March was statistically significant. However, the higher socioeconomic groups tended to feed their children more often than the lower group in all seasons. Thus, while the feeding frequency was low for all children in February/March, it was only in the lowest socioeconomic group it reached an average of less than three times per day.

Variations in Maize Availability

Since maize made up such a large part of the energy intake, the availability and consumption of this grain was crucial for the well-being of the population. In fact, when people talked about "food" they generally meant maize. Furthermore, only eating events where *ugali* or *uji* (for the children) were served were called meals. The following analyses will focus on maize.

Figure 3 shows the percentage of households that did not have any maize left in stock in the pre-harvest months for the two agricultural years included in the survey. As can be seen a few households had run out of maize stocks in November. Around 60% had finished their stocks by May. The figure shows quite large variations between the two years, due to the fact that the harvest in 1987 was unusually poor, because of bad weather.

Table IV shows the average number of months that the households of three socioeconomic groups did not have maize in their household stores. The table shows little difference between the groups when the agricultural conditions are favorable. However, when the climatic conditions worsen, the groups of middle and low socioeconomic standing are hardest hit. The difference between the socioeconomic groups was only significant in the critical period following the harvest in 1987. There was no significant difference in the number of months without maize in stock between those who worked as casual laborers, those who hired laborers and those who were not involved at all.

Household Strategies Affecting Food Availability

Despite the high percentage of households than ran out of stocks, only 10% produced less maize during the main cultivation season (in 1986)

Table IV. Maize Stocks, Length of Time in Three Socioeconomic Groups

Socioeconomic score[a]	Months with no maize in stock	
	Period following harvest in 1986	Period following harvest in 1987
Group 1	2.0	3.8
Group 2	2.2	4.0
Group 3	2.1	2.4
ANOVA Statistics	$F = 0.12$ $p = 0.89$	$F = 4.9$ $p = 0.008$

[a]Households were classified according to the social score into three groups. Group 1 has the lowest score, indicating low socioeconomic status.

than they needed for household consumption until next main harvest. After the main harvest (in July), a certain amount of the crop was set aside and kept in the granaries for household consumption. In addition, some households harvested a small amount of maize from irrigated fields in February/March. However, this was usually not put in the granaries, but picked and eaten as need arised. A few households filled the granaries with maize which was bought or exchanged for other crops.

Usually the amount of maize put in the granaries was estimated to be sufficient for consumption until the next main harvest. The remaining amount, the real surplus, was sold immediately after harvest. However, later in the season many households sold off part of their stocks which had been intended for consumption. These were often small sales, which were carried out in response to immediate cash needs. In this way, households produced a shortage by their selling strategies rather than through production which was insufficient for household consumption. Thus, many households ran out of stocks before they could be replenished by the next harvest.

When it was apparent that the maize stocks would be exhausted before next harvest, people used a variety of strategies to secure food for household consumption. Unripe maize was picked from March/April and onward. Another way of securing food was to grow crops which mature quickly, such as beans or potatoes, for consumption or sale in the lean season.

Women brewed beer for sale. Men could travel to one of the lakes and bring fish back to sell. Both women and men worked as agricultural laborers to obtain cash with which they later could choose to buy food. Some women worked for food, even though this was considered demeaning and a sign of poverty. Furthermore, many households kept cattle, a resource which could be drawn upon if the situation became very bad.

Maize was available at the market in the study area as well as in nearby villages. Therefore, the lack of maize in the household stores did

Table V. Relationship Between Maize Stocks and Number of Feeding/Eating Events Per Day

Maize stores empty, months	*n*	Eating events (adults)	Feeding events (children)
<1	43	3.2	3.4
1–3	46	3.0	3.3
4–6	44	2.5[a]	2.9[a]
>6	33	2.2[a]	2.7[a]
Anova Statistics, main effect after controlling for the effect of village of residency		$F = 6.7$ $p = 0.00$	$F = 4.5$ $p = 0.05$

[a]Significantly different from households with empty stores <1 month, $p < 0.01$ by *t*-test.

not necessarily mean that eating patterns and food intake would be affected. Money from sale of maize, beans, and millet as well as the various other income earning activities would be used to buy food. However, even if these other strategies could buffer the seasonal variations to some extent, early exhaustion of the maize stocks seems to have affected the number of times per day children as well as adults were eating (Table V). Furthermore, the average nutritional status among preschoolers (measured as weight-for-age in relation to the WHO reference standard) was found to be lower in those households that ran out of food stocks early (Holmboe-Ottesen and Wandel, 1991a).

Household members were asked about the most important strategies they used to procure maize when the stocks were exhausted. The majority, 52% of those who experienced food shortage, reported that they resorted to activities where they could earn cash and buy food. Harvest of immature maize was the main strategy for 35%, and 10% worked for food. However, most of the households used a combination of the different ways to procure food. Although exchange of other types of food, such as beans for maize, was quite common in the area, it was not considered the most important way to secure maize when the stocks were exhausted.

As indicated in Table VI, these strategies were employed to different degrees depending on the duration of the maize shortage. Households which were out of stocks for two months or less resorted mainly to harvesting unripe maize. Over 80% of the households which did not have maize in stock for three months or more reported that their main way of procuring maize was purchasing. The procurement of maize by exchange of labor or other food items was less dependent on the duration of the maize shortage.

Table VII shows that in households buying maize, children and adults were eating less often than in households which resorted to other strategies, or where the stocks never ran out. However, since the strategies were closely related to the length of time without maize in stock, they did not exert an

Table VI. Maize Procurement Strategies Related to the Length of Time Without Maize in Stock

		Percent of households[a]		
Maize stores empty	*n*	Buy	Work/exchange	Harvest
< 2 months	48	16	21	63
3–5 months	30	83	4	13
> 5 months	41	83	12	5

[a]Chi-square = 54.8, $p = 0.000$; only households with farming as main economic activity.

Table VII. Relationship Between Food Procurement Strategies and Number of Eating/Feeding Events

	Adults		Children	
Maize procurement	*n*	Eating events	*n*	Eating events
Buy	68	2.4	71	2.8
Work, harvest, exchange	53	2.9	62	3.2
No empty stores	28	2.9	33	3.4
Anova statistics		$F = 6.5$		$F = 6.8$
		$p = 0.002$		$p = 0.002$
Anova statistics with maize stocks and village of residency as covariates				
Main effect		$F = 0.03$		$F = 1.1$
		$p = 0.97$		$p = 0.34$
Maize stocks		$F = 21.4$		$F = 12.9$
		$p = 0.00$		$p = 0.00$
Village		$F = 6.4$		$F = 0.9$
		$p = 0.01$		$p = 0.33$

independent effect on eating patterns. These results were interpreted to mean that households which kept less maize in stock and had to buy maize for a large part of the year, were running a higher risk of having to cut down on the number of eating events. It is therefore interesting to take a closer look at the factors influencing the length of time the maize stocks lasted.

Factors Affecting the Maize Stocks

The effects of different factors expected to influence the maize stocks were estimated for the critical period following the 1987 harvest. The dependent variable was the number of months that the households had maize in stock for the agricultural year, calculated from one main harvest to the next. Thus, the household was considered to have a complete coverage of maize if they had stocks for 12 months.

It was hypothesized that the maize stocks were determined by maize produced (wet and dry season maize); technology of production; amount of maize sold; strategies used to secure food (engagement in beer brewing and business, procuring cash from stocks of beans and millet); socioeconomic, educational and demographic factors (socioeconomic score, mothers and fathers schooling, the relationship between productive and total members of the household, consumption units) as well as village of residency. The different variables included in the analysis and the results are shown in Table VIII.

Table VIII. Maize Stock Model for Harvest 1987[a]

Variable	Regression coefficient	Standardized regression coefficient	*T*	*T* significance
MAIZE DRY	0.83	0.19	2.9	0.005
MO SCHOOL	0.13	0.12	1.5	0.127
MAIZE HARVEST	0.18	0.65	3.9	0.000
BUSINESS	0.13	0.01	0.2	0.843
MILLET STOCK	−0.07	−0.10	−1.5	0.135
TECHNOLOGY	0.02	2.75E-03	0.0	0.969
BEER	0.12	0.02	0.2	0.809
BEAN STOCK	0.11	0.14	2.1	0.037
FA SCHOOL	−0.02	−0.02	−0.3	0.760
VILLAGE	1.51	0.25	3.4	0.001
PROD/TOTAL	−3.94	−0.17	−2.3	0.023
CU	−0.07	−0.05	−0.6	0.548
SES	−4.55E-05	1.12E-04	−0.0	0.999
MAIZE SOLD	−0.18	−0.38	−2.4	0.014

R^2 = 0.41
F = 7.40
Significance F = 0.000
Degrees of freedom = 151

[a](Dependent variable: number of months until next harvest with maize in stock.) List of variables: MAIZE DRY = acres cultivated of dry season maize, 1 acre = 4047 m^2, MO SCHOOL = mother, years in school, MAIZE HARVEST = amount of maize produced in guinea bags, main harvest, 1 guinea bag = 100 kg, BUSINESS = whether or not the household is engaged in trading, yes = 1, no = 2, MILLET STOCK = number of months the millet stocks last until next harvest, TECHNOLOGY = whether or not the household is using fertilizer and/or pesticides, yes = 1, no = 2, BEER = whether or not the household is engaged in beer brewing yes = 1, no = 2, BEAN STOCK = number of months the bean stocks last until next harvest, FA SCHOOL = father, years of schooling, VILLAGE = village of residency 1 or 2, PROD/TOTAL = productive/total members of the household, CU = consumption units, SES = socioeconomic score, and MAIZE SOLD = amount of maize sold, in guinea bags, 1 guinea bag = 100 kg.

We will only highlight some of the results from this analysis. The amount of maize produced at the main harvest (wet season maize) had a significant positive effect on the number of months with maize in stock, whereas the amount of maize sold had a significant negative effect. This may reflect the tendency to oversale which was described earlier. If only the surplus was sold, the household would still have had a complete coverage of maize until next harvest.

Production data for the dry season maize were difficult to collect, due to the practice of picking the maize whenever needed for consumption in the household, so that people did not know how much they had harvested in total. The size of the area cultivated was instead used in the analysis. The

data indicate that the dry season maize had the effect of extending the maize stocks, even though this harvest was small compared to the main harvest.

Whereas there was a positive relationship between bean stocks and the maize stocks, this was not the case for millet. This finding is in line with the in-depth data, indicating that these crops were used for different purposes. Millet was used mostly for brewing of beer, whereas beans were used for direct consumption and for sale. The lack of effect of income generating activities, such as beer brewing and petty commodity trading, may be due to the fact that these activities were also used to obtain cash for purposes other than buying food. Furthermore, they were used both to extend the maize stocks and as a last resort when the maize stocks were exhausted. Thus, a positive effect may be counteracted by these other factors.

There was no independent effect of the socioeconomic score, which may indicate that the relationship seen in Table IV was mediated through other factors. The significant negative effect of the ratio of productive to total members of the household, when the effects of the other factors were accounted for, may reflect larger cash needs in households with many productive members. The village of residency had a significant and quite large effect, which indicates that the food stocks may be handled differently in the two villages.

DISCUSSION

This study shows that even in communities which on the whole are characterized by surplus grain production, there may be seasonal problems relating to food availability and nutritional status. The seasonal pattern in weight-for-age for preschool children indicates that there was a problem in regard to children's nutritional status, especially in the lowest socioeconomic group, which showed a significant decline in February/March—a period of low food availability. Their mothers also seemed to be negatively affected in the pre-harvest season. The difference between the mothers and fathers in regard to weight loss in this season may be related to low food availability as well as hard work: women more than men were working long days away from the house in the weeding period of February/March (Wandel et al., 1992). Thus, the balance between food intake and work output may have been more easily upset for women than for the men. The average weight loss of 3% for mothers lies at the upper end of those found in recent studies in Benin, Ethiopia, and India (Ferro-Luzzi, 1990).

The data on child feeding may seem contradictory to those on nutritional status and food availability, since the feeding frequency was highest in April/May and declined in July/August and February/March. In order

to explain these data we need to consider women's seasonal work (described more thoroughly in Wandel et al., 1992). In April/May, women had more time for cooking and child feeding since there was less agricultural work at this time. Furthermore, food availability was not precarious at this time, because unripe maize could be picked in the fields. Children were fed less frequently during harvest time in July, when food was plentiful, but women worked long days in the fields. However, this peak labor input was much shorter than in February/March. Thus, it is particularly the feeding frequency in February/March that can be expected to exert an effect on nutritional status.

An interesting finding from this study was that the seasonal fluctuations in food availability seemed to be more ambiguously related to socioeconomic parameters than has been reported from seasonal studies in other communities (Chambers et al., 1981). The duration of the maize stocks showed significant differences between the three socioeconomic groups only in one of the years surveyed. Furthermore, there was no indication of more seasonal problems among those who worked as agricultural laborers than among those who hired laborers or those who were not involved. The data from the qualitative study showed that it was not only the poorest people who worked as casual laborers. Anyone would embark on such employment when cash was needed in order to buy desired commodities. None of the households were completely dependent on casual work for their livelihood.

These data are in agreement with results from studies in Zambia (Kumar, 1988) and Malawi (Quinn et al., 1990), which reported that households hiring labor could at other times be selling their labor depending on their current economic situation. The authors of these studies argue that the households which have to sell their labor in the peak labor season in order to make ends meet face a dilemma, since they thereby reduce their opportunities for working on their own farms. The data from the present study did not indicate that this had augmented the seasonal problems with regard to food stocks or nutritional status.

The socioeconomic score did not have any independent effect on how long maize stocks lasted, as shown by the results from the regression model. This indicates that the effect was mediated through other factors included in the model, possibly the production volume of maize in the main season or the opportunity to cultivate beans or dry season maize. The households of higher socioeconomic score would also have an easy access to draught animals, since cattle ownership is included in the scoring system, resulting in more timely and appropriate cultivation conditions.

The effect of village of residency as well as the indication of oversale of maize raises the question of how market activities are related to the use

of maize for subsistence or for sale. Research findings from different societies have shown that an increased cash orientation of agriculture often affects food availability and nutritional status (Biswas, 1979; Dewey, 1981; Pinstrup-Andersen, 1985). Data from other areas in Tanzania have indicated that exchange of subsistence food and cash may have a negative effect on food consumption and nutritional status of children (Jacobsen, 1978; Lev, 1981).

In the earlier publication from this study we reported that nutritional status among preschoolers was better in the non-market-oriented village than in the market-oriented village (Wandel and Holmboe-Ottesen, 1992). In this publication it was also shown that in a year when the production volume on the average was the same in the two villages, food stocks were exhausted faster in the market-oriented village. This could not be explained by demographic differences.

There is reason to believe that thee small-scale sales of maize which had been set aside for household consumption, were particularly relevant in regard to the diminishing food stocks. The in-depth study showed that these sales presented a problem especially in the more market-oriented village, since there was more temptation to spend money there. This was the source of many conflicts in the households in this village (Holmboe-Ottesen and Wandel, 1991b), since it was usually the men who sold maize, very often against the wishes of the women. It is interesting to note that a higher educational background for the mother tended to relate to a longer period with maize in stock, whereas there was the opposite tendency for the father. However, none of these tendencies were significant in this small study.

The seasonal hardships described in this society may seem small compared to those encountered in many other areas. However, people themselves experienced these variations as a problem, often referring to the season of food shortage as "the hunger season." In this paper we have focused on some factors important for the seasonal characteristics of the food and nutritional situations. There are also other factors aggravating seasonal stress, such as gender differences in priorities and division of labor. They have been expanded on in other papers stemming from this study (Holmboe-Ottesen and Wandel, 1991a, b; Wandel et al., 1992).

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